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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/713,879	11/13/2003	Ansheng Liu	42P17910	1108
7590 05/19/2005			EXAMINER	
James Y. Go BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP Seventh Floor 12400 Wilshire Boulevard Los Angeles, CA 90025			CHIEM, DINH D	
			ART UNIT	PAPER NUMBER
			2883	

DATE MAILED: 05/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/713,879

Applicant(s)

LIU ET AL.

Examiner

Erin D. Chiem

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11/13/03 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 11/13/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the various tapering regions and the tapering rates must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to because the reference numbers need to be professionally incorporated into the drawings. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended

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replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claim 22 is objected to because of the following informalities: page 26, line 18, the descriptor --*optical*-- is missing a noun. The Examiner will interpret the descriptor is describing the signal. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. Claims 6, 7, 10, 11, 16, 17, 18, 19, 26, and 27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The Applicant failed to clearly describe the various

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tapering rates. Although a person having ordinary skill in the art would understand the variation of the tapering rates, however, one would also need to understand how the waveguide is tapered. Since the waveguide is formed on a silicon substrate having three dimensions, therefore, a waveguide may taper in three dimensions, hence having three tapering rates in one single region. Therefore the recitation *—first—second—third—fourth—*[tapering] *rate* lacks clarity. The Examiner suggests the Applicant to clearly explain the varying tapering rate in the specification and the drawings to clearly distinct the dimension of tapering.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-13 and 14-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Jeon et al. (US 6,174,748 B1).

Regarding claims 1, 8-13 Jeon et al. teach an apparatus comprising a buried tapered waveguide, referring to Fig. 2, reference number 14A, disposed in a semiconductor layer 10, and a tapered rib waveguide disposed in a semiconductor layer 29, the tapered rib waveguide including a rib portion adjoining a slab portion 16A, the slab portion of the rib waveguide adjoining the buried tapered waveguide. As to the direction of the input light, the apparatus teach by Jeon et al. is bidirectional wherein the coupling of input light is dependent on whether the user wishes to transform a large mode to a single mode or vice versa. Different mode coupling is performed by the tapering region wherein the light traveled through the larger or

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smaller end of the mode converter, when the light reach the tapering region the two different modes are coupled together and then passed on through to either a larger mode or a smaller mode (col.1, line 49-61).

Regarding claims 2-5, the first and second cladding layers are a part of the semiconductor substrates made of indium phosphide layers (col. 3, line 22-27) wherein cladding layers are laterally grown onto the semiconductor substrate for the purpose of confining lights within the active light guiding layers. The buried tapered waveguide is also insulated within the cladding layers. See Fig. 2 for further details.

Regarding claim 6 and 7, as indicated above in the 112 rejection, the recitation of the – *first—second—third—fourth—[tapering] rate* is unclear. The Examiner will interpret the descriptors as four different tapering rates, being lateral or vertical, and the tapering regions may overlap. Therefore, Jeon et al.'s teaching reads upon these limitations. In Fig. 2, the first taper region 28 with the lateral tapering where in the first taper rate is greater than the second taper rate (14b and along the rib where there is no tapering) and the second taper region 25 with the vertical tapering wherein the third taper rate 14A is greater than the fourth taper rate, the region moving away from the pointed tip.

Regarding claims 14-21, Jeon et al also anticipate the method of making a dual tapered waveguide. The etching process begins with etching on a semiconductor wafer (Fig. 3A) through the first mask 31 and the etching of the buried taper waveguide is via a second mask 32 having a larger width end 36 and a smaller width end 34; growing an insulating layer about 100nm to 200 nm thick of SiO₂. The etching process is then patterned the tapered rib waveguide in the silicon grown over the buried tapered waveguide such that a slab portion of the tapered rib

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waveguide adjoins the buried tapered waveguide having a larger end and a smaller end (Abstract and (col. 7, line 55 – col. 8, line 13)).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 22-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeon et al. in view of Soljacic et al. (US 2003/0031443 A1).

Jeon et al. teach a mode converter comprising a semiconductor substrate having dual tapered waveguides wherein there are regions of tapering having different tapering rates such that multi mode signal can be converted to single mode signal and vice versa. However, Jeon et al. do not explicitly teach a system having an optical transmitter to transmit and optical beam and an optical receiver, nor does Jeon et al. explicitly disclose a photonic device optically coupled to the smaller end of the taper rib waveguide from the transmitter by the optical signal to be directed from the tapered rib waveguide through the photonic device to the optical receiver.

Soljacic et al. teach coupling the tapered waveguide as a mode size converter to any optical devices such as a photonic integrated circuit (Fig. 21). Soljacic et al. further defines the coupling of tapered waveguide and a photonic integrated circuit as a bi-stable device since the efficiency confine the signal mode by converting a large mode field to a smaller mode field or vice versa enhances the axial confinement and the radial confinement of the optical signal, thereby, one can form optical cavities having high Q values and/or small modal volumes in the

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waveguides [0013]. Soljacic et al. further applied the bi-stable device as being applicable as an optical regenerator wherein the optical receiver sends its electrical output into an optical transmitter and the transmitter then relay a new optical signal into the fiber. Optical regenerators are used in long-haul transmission applications to remove unwanted effects such as dispersion, nonlinearities, and noise or any other effects that could corrupt the optical signal. When applying the bi-stable device into the optical regenerator, Soljacic et al. demonstrated the all optical signal output from the optical regenerator having definitively two states, high and low (Fig. 42).

Since Jeon et al. and Soljacic et al. are from all from the same field of endeavor, the purpose disclosed by Soljacic et al. would have been recognized in the pertinent art of Jeon et al.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to replace the tapered waveguide used by Soljacic et al. with a dual tapered waveguide taught by Jeon et al. to increase the coupling capability of various optical devices since a dual tapered waveguide may couple an input having any mode field size to one end and efficiently converting the mode such that coupling to the photonic integrated circuit is possible. The motivation would have been increasing the flexibility of optical elements that may be coupled to the bi-stable device needed in the long-haul transmission taught by Soljacic et al., since coupling different mode fields is made possible by the bi-stable device, such that an all-optical output will definitively output only two states, high and low, that makes the transmission truly digital.

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Conclusion


1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yamamoto et al. teach the method of producing a tapered waveguide through determining the rate of the changing taper angle with respect to the normal. Johnson et al. teach the method of fabrication and expanded beam optical waveguide device with the focus on "selective area growth" to form vertical tapering. Forrest et al. teach the application of a dual tapered waveguide as an electroabsorption modulated laser.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erin D. Chiem whose telephone number is (571) 272-3102. The examiner can normally be reached on Monday - Thursday 9AM - 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on (571) 272-2415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Erin D Chiem
Examiner
Art Unit 2883



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